Asset allocation and individual risk aversion

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Abstract (Article Summary)

The results of a study that empirically examined individual asset allocation and risk behavior using financial data for a large random sample of US households are reported. Unlike previous studies, the risk preferences of a sample of individual households, rather than the risk preferences of specific subsets of the general population, are examined. Furthermore, the study's data are relatively current (1985) and far superior to data used in previous studies. A comparison of relative risk-aversion indexes reveals that relative risk aversion is inversely related to age, education, and wealth and income. It decreases as one rises above the poverty level and decreases significantly for the very wealthy. It also decreases with age - but only up to a point. After age 65, risk aversion increases with age.

Full Text (2700 words)

Asset allocation decision-making is one of the least understood areas of finance. Yet how individuals allocate their wealth provides important insights into individual risk preferences and degrees of risk aversion.

Portfolio theory assumes that investors are rational, utility-maximizing individuals who exhibit differing degrees of relative risk aversion, depending on such factors as age, wealth, income and education.(1) Previous studies have employed a variety of approaches to infer individual risk preferences from the proportion of an individual's total

wealth allocated to risky assets.(2) Some of these researchers used questionnaires designed to elicit from individuals explicit answers about their risk preferences; others examine individuals' actual asset allocation decisions.

How individuals actually allocate their assets is often far different from how they say they would allocate them. Examining an individual's actual pattern of asset allocation is thus a far superior method of determining risk aversion than merely asking individuals to respond to hypothetical scenarios. But the results of these studies have been mixed. Depending on how wealth was defined, studies have found that individuals' risk aversion decreased, remained constant or increased with increasing wealth.

This article reports the results of a study that empirically examined individual asset allocation and risk behavior using financial data for a large random sample of U.S. households. Unlike previous studies, it examined the risk preferences of a sample of individual households, rather than the risk preferences of specific subsets of the general population.(3) Furthermore, the study's data are relatively current. (1985) and far superior to data used in previous studies.

THE DATA

The Survey of Income and Program Participation (SIPP) is a longitudinal survey that provides information on the economic status of U.S. households. Interviews are conducted every four months during a two-and-one-half year period.(4) Table I reports the sample's demographic characteristics. (Table I omitted) The composite of the typical respondent unit is a 48-year-old, married, white male with a highschool education, an annual income of $23,000 and household wealth of $40,000.

Table II illustrates the distinct differences in sample mean and median income and household wealth across census regions. (Table II omitted) The average household wealth for the entire sample is $76,860, but this is elevated considerably by a number of very wealthy units. The median wealth figure of $40,395 is more representative of a typical family unit's wealth. The income distribution is less distorted by extreme values, with a mean income of $28,063 and a median value of $23,172.

The study looked at four classes of assets--personal property, real estate, bonds and risky assets. Table III describes how allocations to these assets differ with several demographic and financial variables. (Table III omitted) Consider how the pattern of allocation differs with age.

Individuals 21 and younger have most of their assets in personal property and checking accounts, with very little in risky assets. As expected, the proportion of wealth invested in personal property decreases with age, and the proportion invested in real estate increases. The proportion in bonds and checking accounts is approximately the same for the under-21 category and the 65-and-older category. The proportion in equity increases consistently with age until the age of 65, then falls. This probably reflects the shift toward fixed income assets after retirement. Asset allocation appears to be relatively independent of education for all asset classes except equity, the allocation to which tends to increase with education.

Clear patterns emerge for asset allocations over income and wealth levels. The proportion in risky assets rises consistently with both income and wealth, as the proportion in personal property falls. The proportion in bonds tends to fall with both income and wealth, while real estate exhibits no clear pattern.

Table IV examines asset allocations across geographic locations. Minor differences exist, but they probably reflect differences in income and wealth levels across regions, rather than differences in risk preferences. The East South-Central region, for example, has the lowest proportion of wealth in equity and the lowest median income in the country. The mid-Atlantic region has the highest proportion in equity and the second-highest median income.

INDIVIDUAL RISK AVERSION

The coefficient of the Arrow-Pratt relative risk aversion is measured by the ratio of risky assets to wealth.(6) Following Friend and Blume, we estimate the relative risk aversion index, RRAI, for the kth investor as follows:(7)

Eq. 1

RRAI sub k = (1 - Risky Assets/Wealth = (1 - MPR/RRA),

where MPR is the market price of risk, assumed constant across all investors.(8) The RRA increases (decreases) as wealth grows, indicating that relative risk aversion (RRA) increases (decreases) as wealth increases. An increase in RRAI means an increase in risk aversion. A more risk-averse individual will have a greater proportion of her wealth in low-risk assets. Table V examines differences in RRAI across demographic and financial variables. (Table V omitted)

RRAI decreases with each age category until the 65-and-older category; then it increases significantly. This suggests that individuals generally get less risk averse as they age, until retirement, when they get more risk averse.

Risk aversion appears to decrease with education. However, education, income and wealth are all highly correlated, so the relationship may be a function of wealth rather than education.

The differences in risk aversion and marital status, race and gender appear to be small. Women appear to be slightly more risk averse than men, but this may be more a function of age, income and wealth than gender. Individuals who have never married have a slightly lower RRAI than other categories, with widowed and separated individuals being the most risk averse.

There appears to be a negative relation between risk aversion and income, with RRAI generally falling with income. Very low income families appear to be the most risk averse when measured by EAAI. However, one must be careful in interpreting this finding. Families below the poverty level have little flexibility in their budgets; almost all of their assets are tied up in personal property and housing; this is not because they are very risk averse, but because they have no discretionary income or wealth. Wealth appears to be strongly related to risk aversion, with RRAI falling as wealth increases. The most significant decline comes with very wealthy individuals.

No clear relationships are apparent between RRAI and geographic location. The East South-Central and West South-Central regions have the highest levels of relative risk aversion. This may reflect true regional differences, but it more likely reflects lower average incomes and wealth in these regions.

A MODEL OF RISK AVERSION

The evidence in the tables suggests that the level of relative risk aversion is a function of age, education, wealth and income. Interpretation of the tables also suggests differences in relative risk aversion across three distinct categories of individuals those aged 65 and older, those with incomes below the poverty level, and those with very high levels of wealth. These findings suggest the following model:

Eq. 2

RRAI = alpha + b sub 1 X sub 1 + b sub 2 X sub 2 + b sub 3 X sub 3 + b sub 4 X sub 4 + b sub 5 D sub 1 + b sub 6 D sub 2 + b sub 7 D sub 3

where

alpha = intercept,

X sub 1 = age,

X sub 2 = education (highest grade attended),

X sub 3 total household wealth,

X sub 4 = annual income of participant,

D sub 1 = dummy variable for age; 0 if 65 and 1 if > 65,

D sub 2 = dummy variable for income; 0 if < $10,988 and 1 if >= $10,989 and D sub 3 = dummy variable for wealth; 0 if < $178,419 and 1 if >= $178,419.

The life-cycle theory of asset allocation suggests that individuals become more risk averse as they reach retirement and the need for a fixed income increases. This is reflected in an increasing RRAI after retirement.

Presumably, younger individuals have little need for supplementing current income; they thus tend to invest in assets where the potential for capital appreciation is great, thereby delaying taxes and accumulating assets for the future. In addition, younger investors have more time to recover from a bad investment and are not likely to be forced to liquidate an investment at an inopportune time. Earnings are greatest during the middle-age years, as careers are established and wealth is accumulated; the RRAI thus decreases through these years.

As one reaches retirement age, the need for liquidity increases, as does the necessity of having a predictable cash flow from investments. These changes should necessitate a shift toward lower-risk investments, away from equities and toward fixed income securities. To examine this possibility, the model uses an age dummy variable D,. This takes on a value of 0 if the respondent's age is less than 65 and 1 if the age is 65 or older.

Evidence suggests a negative relation between education and risk aversion (decreasing RRAI; however, one would also expect positive relations between the wealth and income variables and education. It is thus difficult to determine whether it is education per se or wealth and income that affects risk aversion. Education may enlarge individuals' exposure to the various investment options available to them; one might thus expect more educated individuals to be less risk averse in their asset allocation decisions and have a larger proportion of assets in equities.

There is a priori reason to expect a negative relation between income and risk aversion, with higher-income individuals being led risk averse than low-income individuals. As noted, at very low incomes, investment options, other than shelter, are very limited. As income increases, funds available for investment increase, and the RRAI should decline. The ability to take on more risk can be expected to translate into the willingness to accept more risk, because the consequences of a bad investment decision are less severe if one has income beyond some subsistence level. With more and more disposable income, the ability and willingness to accept a larger amount of risk should result in a larger proportion of equity and a decreasing RRAI.

In 1985, the poverty level for a family of four was $10,989. It is unlikely that families living below the poverty level have disposable income to invest in risky securities The model thus incorporates an income dummy variable, D sub 2 that takes a value of 0 if household income is less than $10,989 and a value of 1 if income is greater than or equal to $10,989.

Risk aversion can also be expected to decrease as an individual's wealth increases, independent of income. Someone whose stock of wealth is growing can be expected to become less risk averse as her tolerance of downside risk increases. The ability and willingness to accept more risk should thus increase with wealth, and RRAI should decline.

Summary statistics comparing asset allocation and wealth indicate that the proportion invested in risky securities doesn't change dramatically until wealth reaches the highest decile (90%) at a value of $178,419. At this level, equity represents 13.5% of assets. The model uses a dummy wealth variable, D sub 3 , that takes on a value of 0 if household wealth is less than $178,419 and a value 1 if wealth is greater than or equal to $178,419.

Table VI gives summary statistics for the regression model run on the entire sample of 17,697 observations. (Table VI omitted) The a priori expectation was that the signs of the X sub 1 , X sub 2 , X sub 3 and X sub 4 variables and the D sub 2 and D sub 3 dummy variables would be negative while the sign for the D sub 1 dummy would be positive.(9) In fact, this was the case. Over the entire sample, the signs for the age, education, income and wealth variables X sub 1 X sub 2 , X sub 3 and X sub 4) were negative, and the t-statistic for each variable was significant at the 0.01 level.

The sign for the age dummy variable (D sub 1) was positive and significant, indicating a tendency for risk aversion to increase after age 65. The sign for the income variable (D sub 2) was negative and significant, indicating a tendency for risk aversion to decrease as one passes the poverty level. The wealth dummy variable (D sub 3) was negative and significant, indicating that risk aversion decreases significantly as an individual's wealth rises into the top 10% of the population.(10)

FOOTNOTES

1. Von Neumann and Morgenstern, Theory of Games and Economic Behavior (Princeton: Princeton University Press, 1953).

2. See, for example, Cohn, Lewellen, Lease and Schlarbaum, "Individual Investor Risk Aversion and Investment

Portfolio Composition," Journal of Finance, May 1975; I. Friend and M. E. Blume, "The Demand for Risky Assets," American Economic Review 65(1975), pp. 900-22; Lease, Lewellen and Schlarbaum, "The Individual Investor Attributes and Attitude," Journal of Finance, May 1974; F.W. Siegal and, J.P. Hoban Jr., "Relative Risk Aversion Revisited" Review of Economics and Statistics 64(1982), pp. 481-87.

3. As in Cohn, Lewellen, Lease and Schtarbaum, "Individual Investor Risk Aversion," op. cit.; Friend and Blume, "Demand for Risky Assets," op. cit.; Lease Lewellen and Schlarbaum, "Individual Investor Attributes," op. cit.; Lewellen, Lease and Schlarbaum, "Patterns of Investment Strategy and Behavior among Individual Investors, "Journal of Business. July 1977; and Siegal and Hoban, "Relative Risk Aversion," op. cit.

4. The data were made available by the Inter-University Consortium for Political and Social Research. The data for Survey of Income and Program Participation (SIPP) 1984 Panel!: Wave IV Rectangular core and Topical Module File were originally collected by the US Bureau of the Census. Neither the collectors of the original data nor the Consortium bears any responsibility for the analyses or interpretations presented here. Our sample differs from that of Lease, Lewellen and Schlarbaum ("The Individual Investor," op. cit) in several ways. Their sample tends to be older, better educated and wealthier than the general population. Their data are arguably reflective of the typical investor but not necessarily of the typical household. The largest difference between their sample and the general population as reflected in our data lies in household wealth. Mean household wealth for their sample was $386,000 in 1971; median wealth was $100,000. Our data reveal an average household wealth figure of $76,860 in 1985 and a median wealth of $40,395. In the Lease, Lewellen and Schlarbaum study, wealth more closely approximates total assets, while our figures are closer to net worth.

5. Over 17% of the total sample had an annual income under the poverty level ($10,989).

6. The Arrow-Pratt relative risk aversion measure of individual investors is defined as W sub k - U"(W sub k)/ U'(W sub k)! where W sub k is the kth investor's wealth and U is the utility function of wealth. This measure represents the wealth elasticity of the marginal utility of wealth. See K J. Arrow, Essay in the Theory of Risk-Bearing (Amsterdam: North-Holland, 1971) and J. W. Pratt, "Risk Aversion in the Small and in the Large" Econometrica (1964), pp. 122-36.

7. Friend and Blume, "Demand for Risky Assets" op. cit.

8. Equation (1) is derived maximizing the investor's expected utility of wealth function using **truncated Taylor-series expansion** to obtain the first-order equation, from which a coefficient proportional to relative risk aversion can be estimated. In this approach, taxation and human capital are ignored, and the wealth of individuals is measured net worth.

9. Regression results for the model run without the dummy variables yielded similarly significant results:

(Equations omitted)

10. We thank Linda Culp for her computational assistance.

GLOSSARY

* DUMMY VARIABLE

Used to handle qualitative variables in statistical analyses, dummy variables represent the absence or presence of a factor by taking on a value of 0 or 1.

* RELATIVE RISK AVERSION

An investor's tolerance for risk, measured relative to his wealth level. Mathematically defined here as the value (risk premium) that must be added to the payoff from a gamble in order to make a risk-averse investor indifferent between the gamble and a "sure bet" of the same actuarial value.

* RELATIVE RISK AVERSION INDEX:

An empirical measure estimated as one minus the ratio of an individual's risky assets to his total wealth.